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Project:_____
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Great Job Part 2.

- ADH Approval letter is included
- The existing treatment system [trickling Filter) is unable to meet Nitrate + Nitrite limit (Permit Limit = 10 mg/L (7-day Ave)

  Permitte had 21 - Violations For Nitrate - Nitrite during Past two years.

- The existing Treatment system: Head work, Primary clarifier, trickling filters, Secondary clarifier, biotowers, Final Clarifier and Chlorine disinfection system.
- The proposed treatment system: head work (existing system), extended aeration oxidation ditch, Final Clarifier (existing will be rehabilitated) and U.V. disinfection

- Design flow: based on the average flows Between 2002 and Jun 2005
  Average flow = 0.64

(133 Persons X 100 X $\frac{3 \text{ Person}}{\text{House}}$) New Flatwood Area = 0.0399 mgd

0.68 mgd

Design flow for the existing plat = 0.73 mgd ✓

Using 0.73 mgd as design flow will allow some future growth.

Total Peak Hourly = $\frac{18+\sqrt{P}}{4+\sqrt{P}} = \frac{18+\sqrt{3.4}}{4+\sqrt{3.4}} = \frac{19.84}{5.84} = 3.44$ Mouth factor

$= 0.68 \times 3.44 = 2.33$ MGD

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Date: _____ By: Parvin

Project: Mt. View AR0020117

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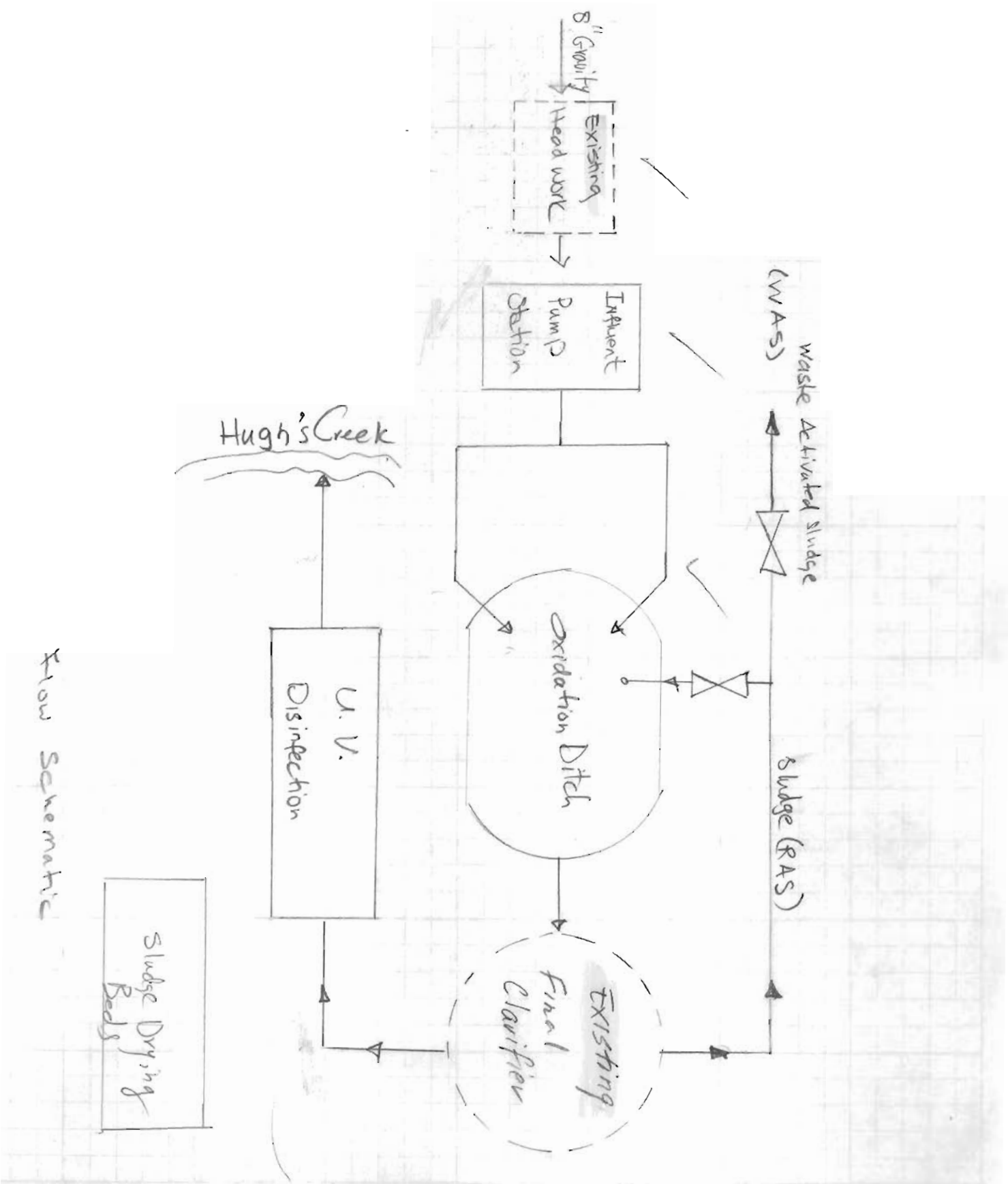

Flow Schematic

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Influent Characteristics

BOD_5 = 200 mg/L
TSS = 200 mg/L
TP = 6 mg/L
NH_3-N = 40 mg/L
TKN = 50 mg/L

Effluent Requirements

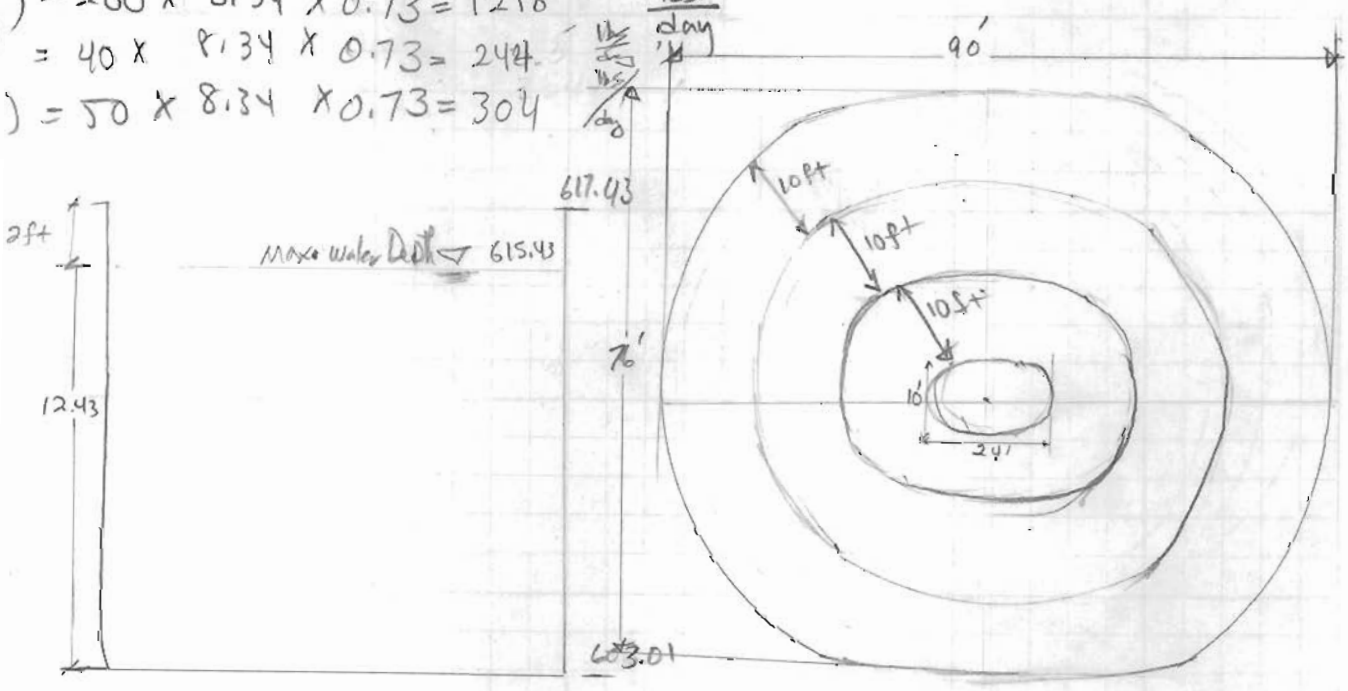
BOD_5 = 10 mg/L
TSS = 15 mg/L
TP = 1.5 mg/L
TN = 10 mg/L

treatment: Extended Aeration Oxydation ditch.

Orbal system by U.S. filter.

Influent Characteristics:
Flow = 0.85 MGD
BOD_5 = 200 mg/l TSS = 200 mg/l TKN = 50 mg/L
NH_3-N = 40 mg/L

BOD_5 (lbs/day) = 200 x 8.34 x 0.73 = 1218 lbs/day
TSS (lbs/day) = 200 x 8.34 x 0.73 = 1218 lbs/day
NH_3N (lbs/day) = 40 x 8.34 x 0.73 = 244
TKN (lbs/day) = 50 x 8.34 x 0.73 = 304



Maximum water Depth = 12.43 ✓
Free Board = 2 feet ✓

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nitrification:

Utilizing the following equation for calculation of minimum detention time for nitrification unit.

$$t_{min} = \left(\frac{1}{\mu_{mx}(1-e^{0.098(T_{min}-15)})}\right) \times (\text{Total process peak factor}) \times (\text{Safety factor})$$

$$t_{min} = \frac{1}{0.47\ day^{-1} \times e^{(0.098(12-15)}} \times (1.56) \times (2.5)$$

$t_{min} = 11.1$ day $\approx$ 12 days (Selected)

Orbal Basin Volume

$$V = \frac{t_{min} \times P_x}{MLSS}$$

P_x = total solid production {Sludge wasted}

$P_x = 1039$ lb/day

MLSS = 3500 mg/L

$$V(ft^3) = \frac{12\ days \times 1039\ \frac{lb}{day} \times \frac{1\ Gal}{8.34\ lb} \times \frac{ft^3}{7.48\ Gal}}{3500\ \frac{mg}{L} \times \frac{1\ L}{1000000\ mg}}$$

$= 571.03\ ft^3$
$= 427132$ Gallon

$$= \frac{232.75}{4000 \times 0.8 \times \frac{1\ L}{1000000}} = 72734\ ft^3$$

Checking with 10-State STD for permissible tank capacity and loading (chapter 90 - Page 9-7)

MLSS = 3500 mg/L

Organic Loading $\left(\frac{lb\ BOD_5}{day \cdot 1000\ ft^3}\right) = \frac{1218\ lb/day}{57103\ ft^3} = 21.3\ \frac{lb\ BOD_5}{1000\ ft^3 \cdot day}$ (1 train)

F/M Ration:

{Volume of Basin is small} $\frac{21.3\ lb\ BOD_5}{1000\ ft^3 \cdot day}$

$\frac{15\ lb\ BOD_5}{1000\ ft^3 \cdot day}$ * (10 State. STD)

$$= \frac{1218\ lb\ BOD_5}{(3500\ mg/L \times 57103\ ft^3 \times 7.48\ gall/ft^3) \frac{MGD}{10^6} \times 8.34\ \frac{lb}{Gal}) \times 0.80}$$

F/M = 0.12

OK 1033 : 0.1

* See US filter rational for volume of Basin

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Aeration equipment: oxygen for BOD_5 | Nitrogenous O_2 req.

10 Stale-STD | $\frac{1.5 \text{ lb } O_2}{1 \text{ lb } BOD_5}$ | $\frac{4.6 \text{ lb } O_2}{1 \text{ lb TKN}}$

Net Oxygen demand:

= Carbonaceous O_2/day (lb) + Nitrogenous O_2/d - Denitrification Cutt/dy (lb)

$= 1157 \frac{\text{lbs BOD}}{\text{day}} \times 1.5 \frac{\text{lb } O_2}{\text{BOD}_5} + 250 \frac{\text{lb}}{\text{day}} \text{ TKN} \times 4.6 \frac{\text{lb } O_2}{\text{TKN}} + 29 \text{ lb } O_2 \left(298 \frac{\text{lb TKN}}{\text{dy}} - 28 \frac{\text{lb } N_{O_3}}{\text{dy}}\right)$

$= 1735 + 1150 - 783$

$= 2087 \text{ lb/day}$

$AOR = \frac{2087 \text{ lb } O_2/\text{day}}{24 \frac{\text{hr}}{\text{day}}}$

$AOR = 87 \frac{\text{lb}}{\text{hr}}$

Field correction factor { Ditch #1 ⇒ DO = 0 mg/L; Ditch #2 ⇒ DO = 0.5 mg/L; Ditch #3 ⇒ DO = 2.0 mg/L } = 0.8

0.4 - 0.7

$STOR = \frac{AOR}{fcf} = \frac{87 \frac{\text{lb}}{\text{hr}}}{0.8} = 109 \frac{\text{lb}}{\text{hr}} \approx 109 \frac{\text{lb}}{\text{h}}$ ✓

Two (2) 10 Hp aerators each turning 18 discs { Rotor-Brush aerators }

Two (2) 30 Hp " " " 36 discs

Total = 80 Hp

$\text{Transfer rate} = \frac{114 \text{ lb/h}}{80 \text{ hp}} = 1.425 \frac{\text{lb } O_2}{\text{hp.h}}$ ✓

M&E (0.9 - 1.76 lb O_2 / hp.h)

$\frac{\text{STOR}}{\text{disc}} \approx 2.5 \frac{\text{lb}}{\text{hr. Dk}}$

/2

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Clarifier

Peak hourly flow : 2.34 MGD

$D_{inside} = 55'$

$A = \pi r^2 = \pi \times 27.5^2 = 2376\ ft^2$

Top of Tank wall = 612.40
Max water surface = 610.98
(on Primatech) Bottom = 599.15

water depth = 11.83 ✓

free Board = 1.42' ✓

Surface over flow rate at Design Peak Hourly flow (gpd/ft^2)

$$\frac{2.34\ MGD}{2376\ ft^2} = 984.84\ \frac{gal}{ft^2} < 1000\ \frac{gal}{ft^2}\ (10\ state\ STD)$$ ✓

Peak solids Loading rate $\left(\frac{lb}{day\ ft^2}\right)$ =

$$\frac{4000\ mgl \times 8.34 \times 0.73}{2376\ ft^2} = \frac{27396.9\ lb/day}{2376\ ft^2} = 11.53\ \frac{lb}{day\ ft^2} < 35\ \frac{lb}{day\ ft^2}$$ (10-state) ✓

UV : disinfection system consist of :

Tot. No. Lamps	32
Modules	4
Lamps/module	8

Peak Design flow = 4MGD
TSS < 30 mg/L
BOD_5 < 30 mg/L
In fluent fecal < 1,000,000/100 m